1 **CLAIMS:**

2 Having thus described my invention, what I claim as new and
3 desire to secure by Letters Patent is as follows:

4 1. A signal separation method comprising restoring an
5 original signal from observed data, obtained by observing
6 multiple mixed signals, including the steps of:
7   estimating, from said observed data, a separation
8 matrix using an adaptive filter that suppresses the H-
9 infinity norm concerning said separation matrix until the
10 H-infinity norm is equal to or smaller than a provided
11 scalar value; and
12   restoring said original signal by multiplying said
13 separation matrix by said observed data.

14 2. A signal separation method comprising the steps of:
15   selecting, for said observed data, a specific
16 separation matrix from among multiple separation matrixes
17 based on MinMax strategy in game theory; and
18   restoring an original signal by multiplying said
19 selected separation matrix by said observed data.

20 3. A signal separation method comprising:
21 estimating and restoring an original signal from observed
22 data obtained by observing multiple mixed signals, which
23 include said original signal, including the steps of:
24   introducing, for said observed data, a cost function
25 based on a function having a monotonously increasing

1 characteristic;

2   estimating a separation matrix using an adaptive filter

3 that optimizes said cost function; and

4   estimating and restoring said original signal by

5 multiplying said separation matrix by said observed data.

6 4. The signal separation method according to claim 3,

7 wherein, the step of estimating a separation matrix includes

8 employing an adaptive filter for minimizing said cost

9 function for said separation matrix.

10 5. The signal separation method according to claim 3,

11 wherein said cost function to be introduced is an

12 exponential type function.

13 6. A signal separation method comprising:

14 separating and extracting an original signal from observed

15 data obtained by observing multiple mixed signals, which

16 include said original signal, including the steps of:

17   reading observed signals;

18   subtracting the average of said observed signals and

19 performing zero averaging for said observed signals;

20   whitening the observed signals obtained by zero

21 averaging;

22   separating said whitened observed signals based on a

23 cost function that has a monotonously increasing

24 characteristic; and

25   performing, as a post processing, inverse whitening for

26 the obtained observed signals.

1 7. The signal separation method according to claim 6,
2 further comprising changing a non-linear function to be used
3 in said cost function employed for said separation based on
4 the kurtosis of each of said observed signals.

5 8. A signal processing apparatus comprising:
6   input means, for receiving observed data obtained by
7 observing multiple mixed signals, which include an original
8 signal;
9   separation matrix estimation means, for estimating, for
10 said observed data, a separation matrix using adaptive
11 filtering for suppressing the H-infinity norm concerning
12 said separation matrix until the H-infinity norm is to equal
13 to or smaller than a provided scalar value; and
14   estimation/restoration means, for estimating and
15 restoring said original signal by multiplying said
16 separation matrix by said observed data.

17 9. A signal processing apparatus comprising:
18   input means, for receiving observed data obtained by
19 observing multiple mixed signals, which include an original
20 signal;
21   selection means, for employing, for said observed data,
22 the MinMax strategy in game theory to select, from
23 separation matrixes, a specific separation matrix; and
24   estimation/restoration means, for estimating and
25 restoring an original signal by multiplying said separation
26 matrix by said observed data.

27 10. A signal processing apparatus comprising:

1   input means, for receiving observed data obtained by

2   observing multiple mixed signals;

3   separation matrix estimation means, for estimating, for

4   said observed data received from said input means, a

5   separation matrix by using an adaptive filter with

6   optimizing a cost function that is based on a function

7   having a monotonously increasing characteristic; and

8   estimation/restoration means, for estimating and

9   restoring an original signal by multiplying said separation

10   matrix by said observed data.

11   11. The signal processing apparatus according to claim 10,

12   wherein said adaptive filter used for said separation matrix

13   estimation means includes a filter for minimizing said cost

14   function for said separation matrix, and said function

15   having said monotonously increasing characteristic is an

16   exponential type function.

17   12. A signal processing apparatus comprising:

18   a non-linear function unit, for performing a non-linear

19   function for an input observed signal and a separation

20   matrix estimated during a previous cycle;

21   an error signal calculator, for calculating an error

22   signal based on the value obtained by said non-linear

23   function unit, said separation matrix estimated during the

24   previous cycle, and said observed signal at a present time;

25   and

26   a separation matrix update unit, for updating said

27   separation matrix estimated at said time based on said error

28   signal, so that error evaluation is weighted by said cost

1   function having the monotonously increasing characteristic,

2   for outputting and/or separating an original signal from an

3   input observed signal.

4   13. The signal processing apparatus according to claim 12,

5   further comprising:

6   a unitarization operator for ensuring the transform to

7   a unitary matrix of said separation matrix that has been

8   estimated at said time and that has been updated by said

9   separation matrix update unit.

10   14. A signal processing apparatus comprising:

11   input means, for receiving mixed speech data obtained

12   by observing multiple mixed speech signals;

13   separation matrix estimation means, for estimating a

14   separation matrix, for said mixed speech data, using an

15   adaptive filter with optimizing a cost function that is

16   based on a function having a monotonously increasing

17   characteristic; and

18   separation/extraction means, for separating and

19   extracting said speech signals from said mixed speech data

20   by multiplying said separation matrix by said mixed speech

21   data.

22   15. A signal processing apparatus for separating an

23   artifact from an observed bio-signal, said apparatus

24   comprising:

25   input means, for receiving observed data containing

26   said artifact in said observed bio-signal;

27   separation matrix estimation means, for estimating a

1 separation matrix for said observed data, using an adaptive
2 filter with optimizing a cost function that is based on a
3 function having a monotonously increasing characteristic;
4 and
5   separation/extraction means for separating and
6 extracting said observed bio-signal from said observed data
7 by multiplying said separation matrix by said observed data.

8 16. The signal processing apparatus according to claim 15,
9 wherein said observed bio-signal is at least one signal of a
10 signal observed using magnetoencephalography or a signal
11 observed using electroencephalography.

12 17. A signal processing apparatus for extracting from
13 economic statistical data, a fluctuation element that is
14 hidden during an observation, comprising:
15   input means, for receiving economic statistical data;
16   separation matrix estimation means, for estimating a
17 separation matrix for said economic statistical data using
18 an adaptive filter with optimizing a cost function that is
19 based on a function having a monotonously increasing
20 characteristic; and
21   separation/extraction means, for separating and
22 extracting said fluctuation element from said economic
23 statistical data by multiplying said separation matrix by
24 said economic statistical data.

25 18. The signal processing apparatus according to claim 17,
26 wherein said economic statistical data, received by said
27 input means, is management data that can be considered as

1 the data that consists of the overall trend and individual
2 factors synthesized by an unknown mixing matrix.

3 19. The signal processing apparatus according to claim 17,
4 wherein said economic statistical data are stock price
5 fluctuation data that are observed as a set, and said
6 fluctuation element that is separated and extracted by said
7 separation/extraction means is a stock price trend for an
8 independent component that can be applied for portfolio
9 return prediction.

10 20. A mobile terminal device, for receiving, from a base
11 station for code division multiple access, observed data
12 that include the spread information to other users, and for
13 extracting a local user signal from said observed data,
14 comprising:
15   input means, for receiving observed data from said base
16 station;
17   separation matrix estimation means, for estimating a
18 separation matrix for said observed data using an adaptive
19 filter with optimizing a cost function that is further based
20 on a function having a monotonously increasing
21 characteristic; and
22   separation/extraction means, for separating and
23 extracting a user signal from said observed data by
24 multiplying said separation matrix by said observed data.

25 21. An article of manufacture comprising a computer usable
26 medium having computer readable program code means embodied
27 therein for causing signal separation, the computer readable

1   program code means in said article of manufacture comprising
2   computer readable program code means for causing a computer
3   to effect the steps of claim 1.

4   22. An article of manufacture comprising a computer usable
5   medium having computer readable program code means embodied
6   therein for causing signal separation, the computer readable
7   program code means in said article of manufacture comprising
8   computer readable program code means for causing a computer
9   to effect the steps of claim 2.

10   23. An article of manufacture comprising a computer usable
11   medium having computer readable program code means embodied
12   therein for causing signal separation, the computer readable
13   program code means in said article of manufacture comprising
14   computer readable program code means for causing a computer
15   to effect the steps of claim 3.

16   24. An article of manufacture comprising a computer usable
17   medium having computer readable program code means embodied
18   therein for causing signal separation, the computer readable
19   program code means in said article of manufacture comprising
20   computer readable program code means for causing a computer
21   to effect the steps of claim 6.

22   25. A computer program product comprising a computer usable
23   medium having computer readable program code means embodied
24   therein for causing signal processing, the computer readable
25   program code means in said computer program product
26   comprising computer readable program code means for causing

1   a computer to effect the functions of claim 8.

2   25. A computer program product comprising a computer usable
3   medium having computer readable program code means embodied
4   therein for causing signal processing, the computer readable
5   program code means in said computer program product
6   comprising computer readable program code means for causing
7   a computer to effect the functions of claim 8.

8   26. A computer program product comprising a computer usable
9   medium having computer readable program code means embodied
10   therein for causing signal processing, the computer readable
11   program code means in said computer program product
12   comprising computer readable program code means for causing
13   a computer to effect the functions of claim 9.

14   27. A computer program product comprising a computer usable
15   medium having computer readable program code means embodied
16   therein for causing signal processing, the computer readable
17   program code means in said computer program product
18   comprising computer readable program code means for causing
19   a computer to effect the functions of claim 10.

20   28. A computer program product comprising a computer usable
21   medium having computer readable program code means embodied
22   therein for causing signal processing, the computer readable
23   program code means in said computer program product
24   comprising computer readable program code means for causing
25   a computer to effect the functions of claim 12.

1   29. A computer program product comprising a computer usable

2   medium having computer readable program code means embodied

3   therein for causing signal processing, the computer readable

4   program code means in said computer program product

5   comprising computer readable program code means for causing

6   a computer to effect the functions of claim 14.

7   30. A computer program product comprising a computer usable

8   medium having computer readable program code means embodied

9   therein for causing signal processing, the computer readable

10 program code means in said computer program product

11 comprising computer readable program code means for causing

12 a computer to effect the functions of claim 15.

13 31. A computer program product comprising a computer usable

14 medium having computer readable program code means embodied

15 therein for causing signal processing, the computer readable

16 program code means in said computer program product

17 comprising computer readable program code means for causing

18 a computer to effect the functions of claim 17.

19 32. A computer program product comprising a computer usable

20 medium having computer readable program code means embodied

21 therein for causing functions of the mobile terminal device,

22 the computer readable program code means in said computer

23 program product comprising computer readable program code

24 means for causing a computer to effect the functions of

25 claim 20.

26 33. A program storage device readable by machine, tangibly

1 embodying a program of instructions executable by the
2 machine to perform method steps for signal processing, said
3 method steps comprising the steps of claim 1.

4 33. A program storage device readable by machine, tangibly
5 embodying a program of instructions executable by the
6 machine to perform method steps for signal processing, said
7 method steps comprising the steps of claim 3.

8 34. A program storage device readable by machine, tangibly
9 embodying a program of instructions executable by the
10 machine to perform method steps for signal processing, said
11 method steps comprising the steps of claim 6.